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GAME RECOMMENDER SYSTEM USING MACHINE LEARNING ALGORITHMS AND KERAS FRAMEWORK

Abstract:
Nowadays the new technologies gave almost everybody who is connected to the internet access to a mass of information and different types of content such as news, movies, music, games, etc. All of these services have recommender system to suggest user the best product or item that related to user preferences, and machine learning algorithms help a lot in this area. The object of this work is to use machine learning and neural networks to create a recommender system for the internet shop of games.

Keywords:
Recommender system, recommendation engine, software development, machine learning, Keras.

1. Introduction

New Information and content are added all the time, and it make available data and information huge for user. This results in several challenges for the user like how to find the right information and content. Therefore, the special systems are needed to identify what a user actually needs and transform this knowledge into the right content. Such systems are called recommender systems.

At past information and content were just stored and accessed easily especially when there were a few users [1]. Due to the quick growth in popularity of the web and with an expanding number of users, modern strategies had to be created. Search engines already helped users a lot by showing results based on search queries [2]. But the ever-increasing number of contents soon had to deal with the fact that a search query might result in hundreds of different items. While search engines solved these issues by using different methods like sentiment analysis or authority scores, other more product focused services had to find different solutions. They added features that gave the user additional information. At the beginning, they included mainly reviews of other users in form of short texts or comments [3].

2. Recommender System

A recommender system is a system that filter the information to predict the suitable item, product, or service to the user. The goal of a recommender system is to produce significant suggestions to a collection of clients for things or items that might interest them.

Recommender systems emerged as an individual field of research in the mid-1990s and derived from different other research areas like cognitive science, approximation theory, information retrieval, forecasting theory, consumer modeling, and also management science [4].

2.1 Types of recommender systems

Content-based Recommender Systems: This systems executing a content-based suggestion approach analyzing a set of records and/or descriptions of things already rated by a user, and build a profile of user interests based on the highlights of the objects rated by that user.

Collaborative Recommender Systems: These systems create a user profile based on ratings of different objects and compare these against a wider user group. The system recognizes similarities between users based on their ratings and makes recommendations based on the inter-user comparison.

Hybrid Recommender System: It is one type of recommender system using both of collaborative and content base recommender system strategies in different ways, in order to get advantage of both of them.

2.2 Machine learning Algorithms in Recommender System

Machine learning is widely used to make recommender systems with some common algorithms, for example:

k-nearest neighbors - is one of Machine learning algorithm that counted on Supervised Learning technique and works on similarity between new case/data and available case/data, and try to put the new case/data into the category that most similar to one from available data.

Correlation- explains how one or more variables are related to each other. These variables can be input data features which have been used to forecast our target variable.

Singular Value Decomposition (SVD) - is used as a collaborative filtering technique. It uses a matrix structure where each row represents a user, and each column represents an item.

Neural Network - is a series of algorithms that tries to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.

Previous Studies

1. Content-Based Recommender System (CBS):

CBS is based on the item's description and a profile of the user's preference. Potential items are compared with the items that were rated by the user and matching of the items is determined. Therefore, by matching user's interest and item features a possible set of recommended items is generated. Here, a user's interest is based on the features present in the objects the user has rated [5].

2. Collaborative Filtering (CF):

The basic idea behind this approach is that ―if users shared the same interest in the past, they would have a similar taste in the future. CF requires a large amount of information about user interests, behavior and activities, which is not an ideal case since it suffers from the data sparsity problem, which leads to poor performance of the RS [6].

3. Demographic recommender:

This system aims to categorize the user based on personal attributes and make recommendations based on demographic classes. An early example of this kind of system was Grundy (Rich, 1979) that recommended books based on personal information gathered through an interactive dialogue. The users responses were matched against a library of manually assembled user stereotypes [7], and the uses demographic groups from marketing research were used to suggest a range of products and services based on demographic data [8].

Proposed Method

As a proposed method we try to use deep neural network to make a recommender system (Fig. 1, 2) by using a new framework technology called Keras, which is a deep learning API written in Python, running on top of the machine learning platform TensorFlow. It was developed with a focus on enabling fast experimentation, in order to go from idea to result as fast as possible [9].

3.1 Why deep neural network?

Deep learning can model the non-linear interactions in the data with non-linear activations such as ReLU, Sigmoid, Tanh. This makes it possible to capture the complex and intricate user-item

interaction patterns. Deep learning can efficiently learn the underlying explanatory factors and useful representations from input data.

There are many popular deep learning frameworks nowadays, including TensorFlow, Keras, Caffe, MXnet, DeepLearning4j, PyTorch, Theano… These tools are developed in a modular way and have active community/professional support.

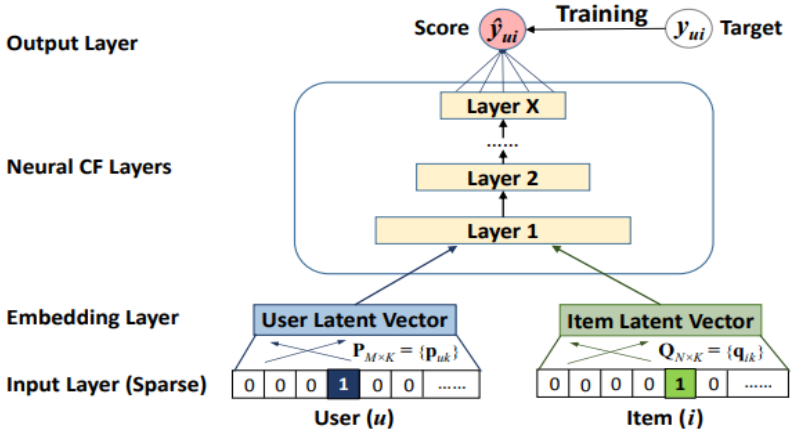

Figure 1 – Neural collaborative filtering framework

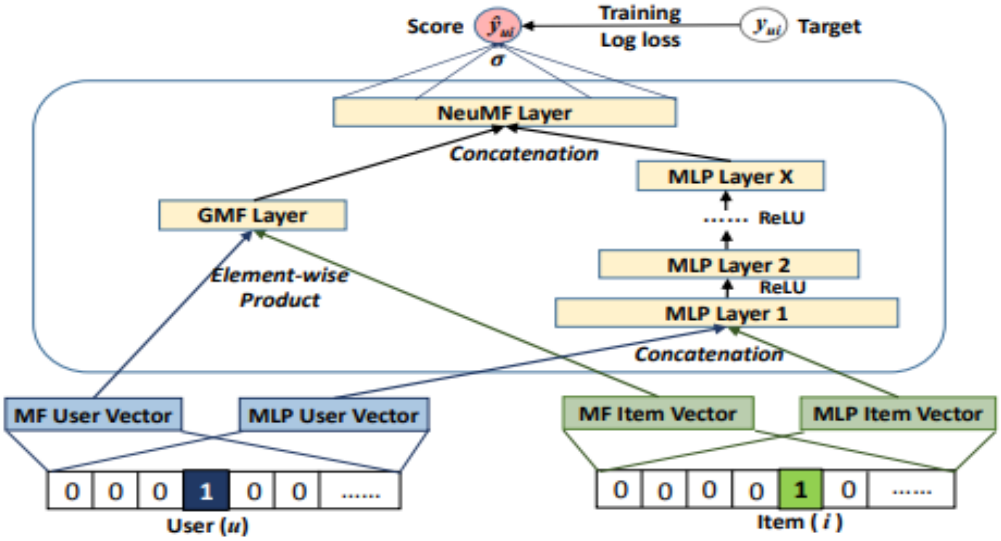

Figure 2 – Neural matrix factorization model

To calculate the predicted rating pi x for user x of an item i, the following Deviation from Mean (DFM) as aggregation approach is used

$$p_x^i = \bar{r_x} + \frac{\sum_{n \epsilon k_x} [sim_w(x,n) \times (r_n^i - \bar{r_n})]}{\sum_{n \epsilon k_x} sim_w(x,n)} \quad (1)$$

Where $\bar{r}x$ is the average of ratings made by the given user x and $\bar{r}_n$, r_n^i is the average of ratings and rating of the neighbor for that item respectively made by the neighbor n. After calculating every possible prediction according to the similarity function Sim w, the mean absolute error (MAE) of the RS is measured as following:

$$MAE = \frac{1}{U} \sum_{u \epsilon U} \frac{\sum_{i \epsilon I_u} |p_u^i - r_u^i|}{l_u} \quad (2)$$

When running the similarity function, U and Iu represent respectively the number of training users and the number of training items rated by the user u.

Conclusion

This paper proposes a neural network recommender system based on Keras framework, which enable us to implement the system with less code and improves recommendation accuracy. By using MAE we can get the error of this recommender and compare to traditional recommender systems, and we can see it is much better and give better performance.

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